Emerging Technologies in Simulation

Virtual Patients
McGill University Experience

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Invitation ➔ Goals

1. Describe + define Virtual Patient (VP)
2. Demonstrate VP examples
3. List competencies taught / assessed using VP's
4. Define supportive technology
5. Describe curricular integration framework
Details from a woodcut done by French futurists, 1910
The Challenge: A Distributed Campus

Glen Site

Montreal General Hospital
David Mulder Trauma Center

Gatineau Campus

St Mary’s Hospital

Jewish General Hospital
8.7 Comparability of Education/Assessment

A medical school ensures that the medical curriculum includes comparable educational experiences and equivalent methods of assessment across all locations within a given course and clerkship to ensure that all medical students achieve the same medical education program objectives.
The Challenge: Curricular Plan

1. Resuscitation
2. Abdominal injury
3. Chest injury
4. Bone / joint injury
5. Hand / wrist injury
6. Burns
7. Head trauma (organ donation)
8. Nerve injury
9. Spinal trauma
10. Urinary tract injury
11. Vascular injury
12. Pediatric trauma
The Virtual Trauma Bay

Slide courtesy of S. Bergman
Goals

1. **Describe + define Virtual Patient (VP)**
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Defining Virtual Patients

“...online representation of clinical cases used in medical education. Widely adopted, they are well placed to teach clinical reasoning skills.”


“...computer-based simulation of a clinical scenario for learning and assessment.”

Ellaway, Candler, Greene, Smothers. MedBiquitous Standards 2006
Goals

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Meet Johnny Delray

John Delray is an undergraduate student who has just finished exams at the end of semester. He and his buddies are going to PARTY! He "loves" beer and pot. Johnny is going to "run" into trouble...
Primary Survey

Choose one of the following

- Airway
- C-Spine Control
- Breathing
- Circulation
- Disability
- Expose the Patient
Airway

This should be your priority but there is something you need to do in conjunction with airway...

Return
Primary Survey

Choose one of the following

- Airway
- C-Spine Control
- Breathing
- Circulation
- Disability
- Expose the Patient
C-Spine Control

An experienced attendant applies in-line immobilization in response to your request.

**Critical Point:** In-line traction must always be applied and maintained throughout the primary survey, particularly in a patient with altered consciousness.
Airway

A moderate amount of blood continues to accumulate in the patient's mouth from the tongue laceration. It is hard to squeeze the Ambu bag in order to get any air in and his $O_2$ saturation continues to fall.

Your next move should be to:

- Intubate the Patient
- Suture the tongue
- Do a cricothyroidotomy
- Assess Circulation
- Send the Patient for a Chest Xray
Send the Patient for a Chest X-Ray

Really not a good idea!

You must complete the Primary Survey and the patient should be stable or improving before doing imaging and they certainly should not leave the Trauma Bay.
Intubate the patient

The intubation goes smoothly. After further suctioning, the rattling sounds disappear. You notice the inspiratory pressure required to ventilate the patient is very high.

- Review Intubation Technique
- Continue
Review intubation

Intubation and Assessment of the Airway in Trauma

Carefully prepare necessary medications and examine your equipment.

Laryngoscope

Endotracheal Tube
Fluid Requirement

How much fluid would you give as a bolus?

- 250cc
- 500cc
- 750cc
- 1000cc

Continue
Your management will include:

- Because of the diffuse nature of the injury all of the bleeding can be controlled easily by applying a tourniquet.
- Establish an airway
- Immediately radiograph the leg in order to determine whether any bony injury has occurred and whether splinting is necessary to help with hemorrhage control
- Once the airway is established make sure the patient is ventilating well.

Continue
Call the trauma staff surgeon

Summarize the case to this point in time as you would present it to the attending trauma staff person. Be comprehensive in your summary and include all pertinent information in 250 words or less.
"This is (Name of Student) calling. I am a third year medical student. We have a young adult male, Mr. Joh Delray, in the trauma bay who was the driver involved in a T-bone car crash. There was substantial intrusion where he was sitting. There were no airbags. He smells of alcohol and he was staggering around the accident site when the ambulance arrived, however, subsequently he became unresponsive. At 3:15, on arrival in the trauma bay, he was somnolent and in severe respiratory distress. He has been intubated. He had a hemopneumothorax and has had a left chest tube inserted. Approximately 600 cc of blood were drained. There are multiple rib fractures and subcutaneous crepitus but he is oxygenating well at this point with a Sat of 90%. He arrived with a pressure of 90 and a pulse of 130 and RR of 30 and shallow. After the chest tube insertion we started two IVs, and after approximately 1 litre of Ringers Lactate his pressure is now 100 and his pulse 120. He has been cross-matched for 6 units and we will give him blood as soon as it arrives. He has a closed head injury that has progressed since the accident. His GCS at 4:15 is 5t (E1 V1 M3). Neurosurgery has been called. On exposing and logrolling the patient there is no obvious abdominal injury, however, his left leg is shortened and internally rotated suggesting a left hip fracture. We are about to start the secondary survey and assuming he continues to stabilize we will take him to CT for a total body scan. Is there anything else you would like us to do for the moment?"
Student Response #1

Question:
Response: This is a young male who was in a car crash early this morning. He presented to the ER with respiratory difficulty and was bag masked and then intubated. He was given a bolus of 1L RL. His vitals are now stable. He has a GCS of 5, and is still in a C-collar. There is bruising on his left abdomen, and crepitus above his left ribs.

WORD COUNT 67
Question: Given the "disability" how would you report the GCS of this patient?
Response: 5

Question:
Response: Mr. Delray is an 18 year old male involved in a severe motor vehicle accident resulting in severe confusion and a scalp laceration with visible bleeding. C-spine precautions were taken and were given O2 by mask on his way to the ER. At this time, his pulse was 130, BP 90, RR 30 and shallow.

In the ER, he was found to have fresh blood in his mouth, two broken teeth, and puncture laceration of his tongue with small bleed which resolved with suctioning. He was in respiratory distress and was successfully intubated. He also experienced a pneumothorax for which a needle thoracostomy was done and a chest tube inserted where 600 ccs were drained. This improved his BP to 100 and pulse to 120. Two IVs were started due to significant blood loss, and he was infused with 1000 ccs of RLs.

His GCS was 5t E1V1tM3 @ 04:13 hours and overall disability status was severe. Upon exposure, there were no obvious injuries to his back or right side. However, there was extensive bruising to his left chest and abdomen with bony crepitus over the lateral aspect of several ribs. His left foot and knee were internally rotated and he reacted with non-directed movement to pressure over his left greater trochanter.

The patient is now stable and undergoing evaluation for admission to the trauma ward for recovery and further management. The plan is to monitor his vital signs and blood volume and ensure he is not hypotensive. Also, labs and CXR are waiting to be done for further assessment.

WORD COUNT 260
Feedback

We want your feedback.

Please let us know if you found errors in the case or have suggestions for improvement.

Send us your comments using the input box below.

If you have any specific questions about this case, please email nancy.posel@mcgill.ca using your own McGill email address.

Thanks for your help. We hope you enjoyed doing the case and that you found it useful.

Submit
“This was super important. To be able to realize the importance of every step of the primary survey; the ‘E’ ... and its relevance ... well appreciated. Thank you for the great case.”
Student Assessment

- Record – route taken through a case
- Scoring based on decisions
- Time – real and relative
- Patient Status – student performance
- Cost – resource utilization
- Summaries – aggregate performance
Goals

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Some Competencies Addressed by VPs

- Critical thinking / analysis, decision-making
- Creating / prioritizing differential diagnoses
- Professionalism, Interprofessionalism
- Therapeutic communications skills
- Scholarship promotion
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Required Supportive Technology

• VP authoring/player application
  – Campus System for Virtual Patients
  – Casus
  – CLIPP
  – DecisionSim (Kynectiv)
  – Open Labyrinth
  – Tusk
  – WebSP
  – WISE-MD

• Internet/Phone

• Standard browser
  – Desktop
  – iPad
  – Mobile phone
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Blended Learning Model: Chest Tube Insertion

Learning Objectives

- Animations
- Virtual Patient
- YouTube
- Lecture
- Simulation
- PPT
- Clinical Practice
Goals

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McGill Experience

VPs are

• useful teaching/learning tools
• helpful with accreditation requirements
• popular with students
• labor-intensive to create
• low cost to create and maintain
• available 24/7
• shareable (?)
• well worth doing!
Thank You!

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Pedagogical Frameworks Supported by VPs

- **Adult learning**: self-motivated, self-directed, autonomous
- **Experiential learning**: direct experience, or reflection on direct experience
- **Situated learning**: environment is set in or similar to clinical setting
- **Cognitive apprenticeship**: coaching, modeling, scaffolding, fading
- **Just-in-time learning**: integrated with real clinical experiences
- **Four Component Instructional Design (4C/ID)**: recognition of complexities inherent in medical learning
4C/ID Definition

- 4C/ID is an instructional design model by van Merriënboer and others.
- "4C" means "four components", "ID" means "Instructional Design". It also can be found in Merrill's first principles of instruction.
- According to Martin Ryder, the 4C-ID instructional model is characterized by four components: (1) Learning Tasks, (2) Supportive Information, (3) Procedural Information and (4) Part-Task Practice. The tasks are ordered by task difficulty and each task offers at the beginning a lot of scaffolding which is reduced as the learner progresses.
- See also: Elaboration theory (a much earlier model from Reigeluth).
Teaching Challenges: Logistics

• Acquire and consolidate knowledge into memory through active learning methodologies
• Apply knowledge using a comprehensive clinical schema/model or algorithm
• Complete cases from a longitudinal perspective
• Access to uncommon clinical situations; fill gaps
Teaching Challenges: Competencies

- Achieve domain knowledge and stage-appropriate clinical expertise within a complex models that require the integration of multiple domains, skills, and attitudes
- Support learners faced with exponentially increasing domain knowledge and practice complexities
- Develop competency in...
  - critical analysis, thinking and decision-making
  - prioritization of the differential diagnoses
  - professionalism, interprofessionalism
  - therapeutic communications skills
  - continuing scholarship
  - transition from generalist to specialist through postgraduate education
  - life-long learning as a practitioner
Mastery Learning

- A variant of competency-based learning in which learners train repeatedly until they have demonstrated mastery of essential knowledge and skills, rather than following a training regimen of a fixed duration of time


- Impact of this approach resulted in quantifiable positive peri- and post-operative outcomes laparoscopic inguinal hernia repair:
  - Operative time
  - Operative performance
  - Patient outcomes – intra operative and postoperative complications

- Zendehas B, Cook D, Bingener J, et. al. Papers of the 131st ASA Annual Meeting
Airway

There is a substantial amount of fresh blood in the patient's mouth, at least two broken teeth and a puncture laceration of the tongue with a small arterial bleeder. On suctioning the blood away and removing the fragments of teeth, his breathing improves but there is still a rattling sound from his throat when he breathes.

- Insert an Oral Airway and Bag the Patient
- Intubate the patient
- Suture the tongue
- Cricothyroidotomy
- Check breathing
“pedagogic scheme,” contextualized, comprehensive

Insert name here
Blended Learning Model: Chest Tube Insertion

- Animations
- Learning Objectives
- Virtual Patient
- PPT
- YouTube
- Lecture
- Simulation
- Clinical Practice
Disclosure

- I have no conflict of interest
- Nobody is paying me to do this
- I am paying my own expenses
- Some images from the internet
- Some images from colleagues
The “Place for the Case”

Continuum of Competency

- Lecture
- Small Group
- CAI
- Core Knowledge

Virtual Patient
- Clinical Decision-Making

Standardized Patient
- History, exam, counseling

Mannequin Simulator
- Procedures, teams, high risk

Real Patient
- Hands-on, patient care

Adapted from Cook & Triola. 2009 Medical Education